

SDMS US EPA REGION V -1

**SOME IMAGES WITHIN THIS
DOCUMENT MAY BE ILLEGIBLE
DUE TO BAD SOURCE
DOCUMENTS.**



Science Applications International Corporation
An Employee-Owned Company

February 14, 1996

Ms. Michelle Simon
U.S. Environmental Protection Agency
National Risk Management Research Laboratory
26 W. Martin Luther King Drive
Cincinnati, OH 45268

Re: EPA Contract No. 68-C5-0001, WA 0-01, TD G
SAIC Project No. 01-0832-07-2611-x08

Dear Ms. Simon:

Enclosed are the revised comments assessing the likelihood of potential for a release of lead in any form to the environment from the manufacturing processes conducted at the Dutch Boy Site.

These comments address potential emissions from baghouses as they applied to the Carter process, the Barton process, a hood over the paint mixing tank, and the in-house vacuum system; from demolition of the building; from the paint mixing process; and from the process water discharge of the Carter process. These comments have been revised based on the conference call held on February 9, 1996 with the EPA/Region V Counsel, Chris Liszewski, and Joan Mattox of EPA/NRMRL.

Please contact either Mr. Clyde Dial or Tom Wagner at (513) 723-2600 if you have any questions.

We appreciate the opportunity to provide this service to you.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

A handwritten signature in cursive script that reads "Kurt Whitford".

Kurt Whitford
Work Assignment Manager

cc: Gene Harris, EPA/NRMRL
Joan Mattox, EPA/NRMRL
Clyde Dial, SAIC
Tom Wagner, SAIC

T:\DutchBoy\in

**Technical Review and Comments on the Potential Release of Lead
From the Manufacturing Processes Conducted at the Dutch Boy Superfund Site**

Background

A number of documents were reviewed as background material for this report. Three depositions supplied most of the information used in this report. These depositions are by Chester Licking on February 24, 1992, Clarence Smith on June 23, 1992, and Roger N. Cieslik on April 30, 1992. A January 19, 1996 memo from Edward Hanlon which summarizes scrape, wipe, and soil samples was reviewed along with one page statements by Frank Cunico, Mark Cunico, Roy Achurra, James McShane, and Hugh Cameron. These items or the cited pages from these references are presented as attachments 1 through 5 respectively.

Mr. Licking's deposition supplies a "history" of the site from 1894 to 1971. Mr. Licking worked at the site from 1929 to 1971 when he retired (pages 13 and 14). He mentions seeing City of Chicago drawings for the plant dated 1894 (page 14) and states this is the earliest date the plant could have opened. Mr. Licking also states (page 121) that National Lead bought Carter White Lead in 1906, but Carter White Lead maintained their corporate entity (sic). Mr. Licking's deposition also gives start dates for the Barton Lead oxide process as 1943 (pages 15 and 36) and the start of the ready mix paint business in 1946 (pages 15 and 16). The exact start date of the ready mix paint process is not clear but it corresponds with diminished white lead production. Mr. Licking (page 38) talks about the mixed paint process occurring after World War II when the white lead plant operation was greatly diminished. He also gives the start date for mixed paint as 1947 (page 124). When Mr. Licking retired in 1971, he states that the plant was producing white lead, Barton oxide, and the mixed paint, but the volume of white lead was extremely low (pages 124 and 125).

Mr. Smith worked at the plant from 1946 to July 1977 (page 4) and remained at the plant for approximately 6 months after it was sold in 1977. This deposition (pages 190-192) discusses the sale of the plant as of January 1, 1977 and indicates that although the plant was sold, the former owner continued to operate the Barton process onsite for a period of time, that the white lead process was no longer running, and that the new owner operated only the ready mix paint process.

Mr. Smith's deposition provides estimates of production for paint at 2-2½ million gallons per year during 1971 to 1976 (pages 57 and 58), for lead oxide at 10,000-15,000 tons per year for 1970-1976 (pages 89 and 90), and for white lead at 5,000-6,000 tons per year for the mid 1960's dropping to nothing in 1971 or 1972 (page 121). He also indicates that not over 5 percent of the white lead produced at the plant in the mid 60's was used by the plant in the mixed paint process (page 122).

Mr. Cieslik's deposition (pages 46 to 49) gives some information pertaining to the demolition during 1986. He describes someone using an acetylene torch to cut up baghouse pipes that were encrusted with a white powder. The specific process from which these pipes were taken was not identified during our limited review. It is not known whether identification is possible from the available information.

The one page statements indicated that bags in the dust collectors did malfunction (burn) at times and that other process equipment incurred spills and leaked dust at various times in the oxide plant (Frank Cunico).

Air Emissions

Air emissions from the Dutch Boy Superfund site in Chicago, Illinois (see Attachment 6 for Plant layout) came from the following activities:

- Carter process for the manufacturing of white lead (see Attachment 7)
- Barton pot process for the manufacturing of lead oxide (see Attachment 8)
- Mixed paint process
- In-house vacuum system
- Demolition of several onsite buildings

Air-borne lead emissions from these activities were calculated from emission factors found in U.S. EPA's Compilation of Air Pollutant Emission Factors otherwise known as AP-42. These emission factors are average values which relate the quantity of a pollutant released to the atmosphere with the activity associated with the release of that pollutant. Using these factors permits the estimation of emissions from sources of air pollution at the site.

Emission factors are very useful tools for estimating emissions of air pollutants. However, because such factors are averages obtained from data of wide range and varying degrees of accuracy, emissions calculated this way for a given facility are likely to differ from that facility's actual emissions. Because they are averages, factors will indicate higher emission estimates than are actual for some sources, and lower for others. Only specific source measurement can determine the actual pollutant contribution from a source, under conditions existing at the time of the test. For the most accurate emissions estimate, it is recommended that source specific data be obtained whenever possible.

The site manufactured a white lead powder by the Carter process. The white lead was then mixed with linseed oil and packaged in metal containers. The process included a collecting drum, a cyclone, and a baghouse operating in series before venting to the atmosphere. While these pieces are normally considered air pollution control equipment, they were part of the process since they were used to collect the white lead powder. The emission factor for the Carter process listed in AP-42 is:

0.55 lb of lead emitted/ton of product produced

The only production records available indicate an annual production ranging from 5,000 to 6,000 tons. These production numbers are estimates taken from the Clarence Smith deposition for the mid-1960's when production was leveling off or even declining. It is likely that production numbers were higher in the preceding decades. A conservative estimate of air emissions from this process was made by assuming an annual production of 5,000 tons over the entire time the process operated (1906-1970). The following is the calculation of emissions from the Carter process:

$$5,000 \text{ tons/year} \times 0.55 \text{ lb lead/ton} \times 1 \text{ ton}/2,000 \text{ lbs} = 1.4 \text{ tons/year}$$

$$1.4 \text{ tons/year} \times 65 \text{ years} = 89 \text{ tons emitted from 1906-1970}$$

The Barton pot process produced lead oxide which was then used in the manufacturing of lead/acid storage batteries. The process included a settling chamber and a baghouse operating in series before venting to the atmosphere. This equipment is considered part of the process and not air pollution control equipment. The emission factor for the Barton pot process listed in AP-42 is:

0.44 lb of lead/ton of product produced

The only records available list production ranging from 10,000 to 15,000 tons per year. These production numbers are estimates taken from the Clarence Smith deposition for the period of 1970-1976. A conservative estimate of air emissions from this process was made by assuming an annual production of 10,000 tons over the entire time the process operated (1943 - 1977). The following is the calculation of emissions from the Barton pot process:

$$10,000 \text{ tons/yr} \times 0.44 \text{ lb lead/ton} \times 1 \text{ ton}/2,000 \text{ lbs} = 2.2 \text{ tons/year}$$

$$2.2 \text{ tons/yr} \times 35 \text{ yr} = 77 \text{ tons emitted from 1943-1977}$$

An estimated 5 percent of the white lead produced at the site was used in the manufacture of lead-based paint. AP-42 estimates a 0.5 to 1.0 percent loss of lead powder from handling. This lead powder was collected by a hood, then vented to a baghouse. A conservative estimate of air emissions from the mixed paint process was made by using an annual white lead production number of 5,000 tons. Using good engineering practice, the efficiency of the baghouse was assumed to be 99 percent. The process operated from 1947 to 1980. The following is the calculation of emissions from the mixed paint process:

$$0.05 \times 5,000 \text{ tons/yr} \times 0.005 \times (1 - 0.99) = 0.012 \text{ tons/yr}$$

$$0.012 \text{ tons/yr} \times 34 \text{ years} = 0.42 \text{ tons emitted from 1947-1980}$$

Little information is available about the in-house vacuum system other than it was controlled by a baghouse. Assuming the system was well-designed and well-maintained, emissions from this source should be negligible.

In order to run EPA's basic dispersion model (SCREEN2) which assumes worst case meteorological conditions, the following inputs would be needed.

- stack height
- stack diameter
- stack exit velocity
- stack exit temperature
- building dimensions
- distance to fence line

These inputs were not provided; therefore, the model could not be run. Assuming each process had a short stack and a low exit velocity and temperature, most of the stack emissions would have settled out within several hundred feet of the stack.

Demolition

Buildings used to produce lead oxide, white lead, and lead-based paint were demolished in the mid-1980s. Emissions from demolition activities at this site can be broken down into the following categories:

- Mechanical dismemberment of existing structures
- Loading of debris into trucks
- Truck transport of debris on unpaved soils

AP-42 states that emission factors are not applicable for the mechanical dismemberment of buildings. Emission factors are given for truck loading and transport; however. In order to calculate emissions, the concentration of lead in the debris; the number of trucks used to remove the debris; the weight, speed, and number of wheels of the trucks used; silt content of the road surface; and annual precipitation must be known. It is not possible to estimate any of these values; therefore, no emission estimates can be made about these activities.

Like the stack emissions, lead particles that became airborne from the demolition activities, also would have fallen out within several hundred feet of the demolition activity.

Process Water From the Carter Process

The process diagram shown as exhibit No. 6 in the deposition of Chester Licking shows a wastewater stream from the settling tubs and pulper of the Carter Process to the sewer. The purpose of these settling tubs is to concentrate the water slurry of white lead prior to the pulper which mixes the white lead with oil.

No flow data or the volume of this stream was identified in material reviewed. The pH of this solution was not presented in the material reviewed. Without this information, quantitative estimates of the lead concentration in this stream cannot be made. However, white lead (also known as lead carbonate or basic lead carbonate) has a fixed solubility in water at a given pH. This soluble lead would be in addition to any fine particulate that could be carried out in the stream. Without the volumetric flow rate of the stream and the pH, no quantitative estimate is possible. Besides, the soluble lead in this stream could be insignificant compared to the particulate lead physically carried by the stream.

Consequently, as stated, some lead would be present in this stream, but its relative amount compared to other sources cannot be determined. No links between this source and soil contamination were established during this review.

Wastewater From Ready-Mix Paint

Paint is generally classified as either water base or solvent (or oil) base, depending on the dispersing medium. They are manufactured in batches, as small as 50 gallons for custom runs or as large as 10,000 gallons for stock items. Paint plants ordinarily formulate products only; that is, they grind raw materials if required and blend them together. No chemical changes occur during the process. Wastewater is generated primarily from the rinsing of water-base paint tanks and filling equipment. Additional wastewater may be contributed from floor cleaning, spill residue, bad product batches, plant and laboratory sinks, contaminated storm water runoff and contact water from air pollution control devices. Some plants occasionally or routinely clean both solvent base and water base tanks with caustic solutions. The caustic rinse is followed with a water rinse which can contribute to the plant's total process wastewater load.

In an EPA National Survey of the Paint Formulation and Allied Products Industry conducted in the late 1970's, it was learned that, at approximately 1,500 manufacturing sites in the United States, roughly 1.5 million gallons of water was generated daily. During the same time frame, EPA conducted a sampling program under which treated and raw paint plant wastewaters were sampled at 22 representative paint plants. These 22 plants covered the full range of product and formulations observed in the industry. As part of this sampling program, a total of 60 untreated wastewater samples were collected and analyzed for lead (Pb) content. The average lead concentration found was 6,300 ug/L (median = 805 ug/L, range = 22-80,000 ug/L). The large range can be attributed to the fact that some of the sampled plants did not use lead in their formulation processes while others did. Samples were also gathered at those plants that practiced batch physical-chemical treatment of wastewater. For 36 treatment batches, influent lead averaged 6,033 ug/L while effluent lead averaged 1,062 ug/L, equaling a percent reduction of 82. Again, no links between this source and soil contamination were established during this review.

D-1D-4.8p

Attachment 1

**Cited Pages From the Deposition of Chester Licking
Given on February 24, 1992**

(13, 14, 15, 16, 36, 38, 121, 124, and 125)

1 Society.

2 Q Was the company a member of any industry
3 groups?

4 A Yes. The company was a member of the American
5 Paint Association.

6 Q Did you visit other paint factories during
7 this time period?

8 A I -- yes, I did. I think I visited all of the
9 existing paint plants in the City of Chicago during that
10 time.

11 Q Now, after you retired from NL Industries in
12 1971, did you do any work related to the paint industry?

13 A Yes. I offered consulting advice and was a --
14 had some clients after I retired from National Lead in
15 the paint industry.

16 Q Did this allow you to stay current with what
17 was happening in the industry?

18 A It allowed me to stay current and also to meet
19 with some of the men who I had formerly had contact
20 with.

21 Q Mr. Licking, can you briefly summarize the
22 history of the plant in Chicago, the NL plant, when it
23 opened and what the major additions were in the plant?

24 A I can -- I can give you exactly what happened

1 from 1929 to 1971, when I retired. I can also give you
2 some supporting information confirmed by City of
3 Chicago, approved drawings for the plant that started in
4 1894. I saw those drawings at that time. So the plant
5 would not have been -- would have been started shortly
6 after 1894. I also saw --

7 Q Let's stop there. Mr. Licking, you referred
8 to City of Chicago approved drawings. What are you
9 referring to?

10 A The Building Department of the City of Chicago
11 approves all structural drawings for all buildings in
12 the city. And they stamped the blueprints that we had.
13 It wasn't a tracing at that time. They stamp the
14 blueprints showing Building Department approval and the
15 date on those prints, which gives you the date and
16 which, before that, the plant could not have been built.
17 But it could have been from then on.

18 Q So the earliest date the plant could have
19 opened was in 1894?

20 A Yes. Now, wait a minute. Yes, that's it.
21 Because the area of the West Pullman was incorporated
22 in -- in City of Chicago in 1894. That's right.

23 Q Okay.

24 A I had forgotten about that.

15

1 Q Why don't you describe the operation or
2 operations that were taking place at the plant in 1929
3 when you first came there, just in general terms, and
4 we'll get into details later.

5 A In 1929, it was strictly a white lead
6 manufacturing plant.

7 Q Is that called the Carter white lead process?

8 A It was by the Carter process. The Carter
9 process was a process patented. The patent had expired
10 by the time I came to the City of Chicago. It was --

11 Q Well, we'll get into the Carter process in a
12 moment, Mr. Licking.

13 What was the next major addition in the
14 plant's operations after 1929 when it was a Carter white
15 lead process?

16 A There were no major additions to the Carter
17 process.

18 Q I understand that. But what happened next in
19 the plant's history?

20 A Oh. Let's see. In 1943, the Navy came to
21 National Lead and asked that they start a Barton oxide
22 plant for the purpose of making lead oxide for Navy
23 submarines used in the war. The next major change was
24 when the company decided to go in to the ready mix paint

1 business in 1946.

2 Q Was that the last major addition of the plant?

3 A Yes. Because by that time, the white lead
4 business had dropped off so that there was insufficient
5 operation --

6 Q Okay.

7 A (Continuing) -- to continue to operate.

8 Q So these other businesses were added?

9 A Yes.

10 Q Okay. Can you generally describe the
11 character of the neighborhood surrounding the Carter
12 plant, the NL plant?

13 A The neighborhood surrounding the Carter plant
14 was primarily heavy industrial in operation. Adjacent
15 to the site of the Carter plant was an International
16 Harvester plant. Just beyond that plant was an Allied
17 Casting plant, which was a malleable and cast iron unit.
18 Across the street from the Carter plant was Ingersol
19 Steel & Disk Company, which manufactured heavy
20 agricultural equipment.

21 Let's see. The other corner was an empty
22 building that had no occupancy while I was there.
23 Across the street was a Verson Steel plant,
24 manufacturing heavy stamping machines. That surrounds

1 A Except in size, it appears to be identical.

2 Q Okay. Why don't we use the larger version
3 just so you can see it better. First of all, can you
4 describe what this is and how it was prepared?

5 A This is a, likewise, a patented system of --
6 patent has also run out on it. It was installed at the
7 Carter plant in 1943 at the behest of the Navy
8 department, who were in badly need of some lead oxide
9 for submarine batteries.

10 The system's provision makes a melting
11 Barton pot, which is the -- the pot over to the left, in
12 which molten pig lead -- molten lead is dropped into and
13 stirred with an agitator. The process is actually an
14 oxidation or burning process that is similar to what
15 happens in all material. It would -- develops a
16 tremendous amount of heat. The Oxofhermic,
17 O-x-o-f-h-e-r-m-i-c, process is very high.

18 The exhaust from the pot was developed by
19 a fan system, which drew the material out of the pot
20 into a settling chamber. The settling chamber was such
21 size that the velocity of the gas flow through it
22 permitted the particles to drop out or to settle to the
23 bottom chamber, which also has a rotary seal. The --

24 Q The seal would then feed to the enclosed screw

1 MR. RUNNING: Would you mark this as Exhibit

2 87

3 (WHEREUPON, a document was marked a
4 LICKING Deposition Exhibit No. 8.
5 for identification, as of 2-24-92.)

6 (WHEREUPON, said document was
7 tendered to the witness.)

8 BY MR. RUNNING:

9 Q Mr. Licking, can you identify the pencil
10 drawing that's before you, marked as Exhibit 87

11 A Yes, I can identify that. That is one that I
12 made.

13 Q Unlike the two preceding diagrams which we had
14 a graphic artist neaten up, if you will, this is your
15 original handwritten --

16 A This is the original handwritten freehand
17 drawing.

18 Q What does it depict?

19 A This represents the mixed paint process that
20 occurred at the Carter plant after World War II, when
21 the white lead plant operation was greatly diminished.

22 Q Okay. Now, I see a dashed vertical line about
23 two-thirds of the way from left to right on the diagram.
24 What does that depict?

1 A It would have been either the controller or
2 the accounting department.

3 Q All right, sir. Do you know in 1929 were
4 there other companies making white lead?

5 A Yes, there were other companies making white
6 lead, in 1929.

7 Q All right. Do you know approximately how many
8 others were making white lead?

9 A I know of only one other one in Chicago.

10 Q And who was that?

11 A National lead.

12 Q National Lead. Who are we? Who are you?

13 A At the time, in 1929, we were Carter White
14 Lead.

15 Q Okay. So at some point National Lead merged
16 with Carter White Lead?

17 A No. In 1906 National Lead bought Carter White
18 Lead, but Carter White Lead maintained their corporate
19 entity.

20 Q Until what time?

21 A I do not know when they -- when it was sold
22 out. It was a -- I do not know.

23 Q Okay. Were you aware, in 1929, of other
24 companies outside of the Chicago area that were making

1 plant had not quite started at that time.

2 Q All right, sir. And again, three shifts a
3 day?

4 A Yes, three shifts a day.

5 Q All right. And the products that were being
6 produced at that time were the white lead and the Barton
7 oxide, is that correct?

8 A That is correct.

9 Q And in 1946, were there any other products
10 being made at that time?

11 A There were no other products being made at the
12 Carter plant in 1946, than the white lead and the Barton
13 oxide.

14 Q Okay. Now, there came a time when there was
15 another product that was made, is that correct, or two
16 more products that were made, mixed paint?

17 A Mixed paint was another product that developed
18 after 1946.

19 Q All right. And do you recall approximately
20 when NL began making the mixed paint?

21 A Approximately 1947.

22 Q All right, sir. And when you retired in 1971,
23 was the company still producing the white lead, the
24 Barton oxide, and the mixed paint?

VICTORIA COURT REPORTING SERVICES, INC.

1 A Yes, they were still producing the white lead,
2 the Barton oxide, and the mixed paint, but the volume of
3 white lead was extremely low.

4 Q All right. -- Let's talk about that for a
5 minute. Let's say in 1946, what percentage of the plant
6 was devoted to producing -- of your overall production,
7 what percentage was the white lead and what percentage
8 was the Barton oxide?

9 A Okay. Are you -- in percentage figures you're
10 asking, are you speaking of area now or --

11 Q Volume of products sold I guess is the way I'm
12 looking at it.

13 A The volume of products sold.

14 Q Right. In other words, say 50 percent of the
15 activity was devoted to the Barton oxide and 50 percent
16 of the business in 1946 was devoted to the white lead.

17 MR. RUNNING: Are you asking by -- measured by
18 dollars or by pounds?

19 MS. HERDINA: By pounds.

20 BY MS. HERDINA:

21 Q Or is that how you sell the material?

22 A If you're referring to it by pounds, you're
23 going to get an erroneous answer -- you're going to get
24 an answer that's going to be very difficult for you to

Attachment 2

**Cited Pages From the Deposition of Clarence Smith
Given on June 23, 1992**

(4, 57, 58, 89, 90, 121, 122, 190, 191, and 192)

1 factory?

2 MS. HERDINA: That's correct, just the
3 Chicago.

4 A. I can't answer the question for any
5 place but this factory, so anything that pertains --

6 Q. (By Ms. Herdina) Let's assume that
7 unless I specify otherwise, I'm talking about the
8 Chicago plant.

9 A. At the specific date, I don't know. We
10 were producing anywhere from 2 million to 2 1/2
11 million gallons a year in mixed paint.

12 Q. Was there a period in time when that
13 amount was higher or lower?

14 A. Oh, yes. Paint was a seasonal
15 production, for one thing. In the wintertime, of
16 course, you didn't produce any exterior paints or very
17 little exterior paints. Your production was interior,
18 and, obviously, your consumption was smaller. Then in
19 the summertime, it would increase.

20 Q. But if I understand what you're saying,
21 you're saying on an annual basis, you sold from 200 to
22 250 million; is that correct?

23 A. To the best of my memory, that's about
24 what we were producing.

25 Q. In December of 1976?

1 A. (No response.)

2 Q. Again, your best estimate.

3 A. I would say in December we were not
4 producing at that rate.

5 Q. How about for the year 1976?

6 A. Somewhere between 2 and 2 1/2 million.

7 MR. RUNNING: Counsel, I think you said
8 200 to 280 million, and I think the witness said 2 to
9 2 1/2 million.

10 MS. HERDINA: Two to 2 1/2 million.

11 Q. I assume as the general superintendent
12 of the plant, you're generally familiar with the
13 production capabilities of the plant and the
14 production at the plant; is that correct?

15 A. In general, yes.

16 Q. So let me ask you: The figure 2 to 2
17 1/2 million gallons of mixed paint, was that a figure
18 that NL produced at the Chicago plant, say, from 1970
19 to 1976? Or was that figure -- let's take 1970. Was
20 was it less in 1970 or more in 1970, to the best of
21 your recollection?

22 A. I really can't say, but I think it
23 would -- well, it would have been fairly consistent
24 over the years, over the last five years.

25 Q. All right.

1 Q. Were the dust collectors that were used
2 in the mixed-paint process -- were those DRACCO dust
3 collectors?

4 A. I believe all of them were Drakes.
5 DRACCO was merely a company who manufactures them --

6 Q. Right.

7 A. -- not really a type.

8 Q. Let's talk about the lead oxide process
9 or production part of the plant that existed in
10 December of 1978. Okay?

11 A. Okay.

12 Q. Now, I believe you talked about -- you
13 referred to that as the Barton process; is that
14 correct?

15 A. Right.

16 Q. You earlier testified that the end
17 product was a grayish-brown powder that was used in
18 car batteries; is that correct?

19 A. Yes. Some industrial batteries also.

20 Q. Okay. What what would the grayish-
21 brown powder be made up of?

22 A. Lead oxide and a small percentage of
23 metallic lead.

24 Q. Let me start with the production end of
25 things. In 1978, do you know the volume of lead oxide

1 that was being produced in the Chicago plant?

2 A. In 1976? I'm estimating somewhere
3 around probably 10- to 15,000 ton a year was somewhat
4 the normal volume which was produced down there.

5 Q. All right. What about 1970? Do you
6 recall roughly the same amount?

7 A. I'll almost have to give the same
8 figures because it would vary at times. The maximum
9 production was a little less than that. Also, there
10 was a little more than that, and obviously, from there
11 on, we could go down to zero.

12 Q. Would it be fair to say at least from
13 the time that you became the general superintendent of
14 the plant, the amount of tons produced per year of the
15 lead oxide was fairly consistent?

16 A. Fairly consistent. We had our ups and
17 downs, as in any business.

18 Q. Okay.

19 A. It would have been fairly consistent at
20 that point.

21 Q. Now, the lead oxide process obviously
22 used lead; is that correct?

23 A. Right.

24 Q. And it used white lead?

25 A. No.

1 Q. What about the heavy?

2 A. The one in 1- and 5-pound tins was used
3 primarily for pipe dope, thread dope to keep pipes
4 from leaking.

5 Q. Did you have any major customers for
6 the heavy paste that you can recall?

7 A. No major customer, no. Once that was
8 sold in paint stores to retail customers.

9 Q. Same with the soft paste? It was
10 basically sold to retail customers?

11 A. Right, uh-huh.

12 Q. Do you recall in 1971 or '72 when white
13 lead was -- when that process stopped at the plant.
14 approximately how much white lead was being produced?

15 A. I couldn't give you a figure on
16 tonnage, no, not at at point because it was dying.
17 Business sort of tapered off, and come '71 or '72, we
18 obviously weren't producing any. It was a dead
19 business.

20 Q. Let's take this back, say, to the
21 mid '60s. Do you have any idea how much you were
22 producing at that point in time?

23 A. I would say not over maybe 5-, 6,000
24 tons a year. This is a very rough estimate. I don't
25 know.

1 Q. With respect to, say, the point in time
2 when you became the superintendent of the plant, do
3 you know approximately how much was being produced?

4 A. You say the '60s and --

5 Q. Mid to late '70s.

6 A. Maybe not much more, probably about the
7 same amount.

8 Q. In the area of 5- to 6,000 tons?

9 A. Five- to 6,000 tons a year.

10 Q. A portion of this white lead was used
11 by the plant in the mixed-paint process; is that
12 correct?

13 A. Right, uh-huh.

14 Q. Do you have an idea, let's say, in the
15 mid '60s what percentage was used by your own plant,
16 say, if they were producing roughly 5- to 6,000 tons
17 per year?

18 A. It would have been a various ballpark
19 percentage in the '60s. I would say not over 5
20 percent.

21 Q. Per year?

22 A. Per year. Uh-huh. That may be
23 stretching it a bit.

24 Q. Do you know why the amount that was
25 produced decreased over time?

1 A. Yes.

2 Q. Do you know who ran the urine samples?

3 A. No, I don't.

4 Q. Was there a plant nurse?

5 A. No.

6 Q. I think you've answered this already,
7 but I'm going to ask you again to be certain. To the
8 best of your knowledge, was there ever any city,
9 state, or federal monitoring of the air that was
10 leaving the site out of the exhaust stacks for lead
11 content?

12 A. Not to my knowledge, no.

13 Q. What was your involvement, if any, at
14 the time that the NL -- that portions of the NL plant
15 were sold to ELT or ARTRA?

16 MR. RUNNING: I object to the
17 characterization. The plant was sold, as you know,
18 from reading the agreement. There was an agreement
19 that certain operations could continue for a period of
20 time, but the reality was it was sold.

21 Q. (By Ms. Herdina) What was your
22 involvement in the transaction?

23 A. None. I was not involved in it at all.

24 Q. So you did not participate in any of
25 the negotiations concerning the sale?

1 A. No, not at all, none.

2 Q. All right. Is it your understanding
3 that the equipment relating to the mixed-paint process
4 was sold to ELI?

5 A. It is my understanding that's what it
6 is on the basis that on the 1st of January of '77, the
7 equipments continued to be operated and run by ELI.

8 Q. Now about the Barton process equipment?
9 Was it your understanding that that equipment was sold
10 to ELI or it still belonged to NL?

11 MR. RUNNING: I object to this line of
12 questioning. If you'll allow me to make the
13 objection, the agreement has been produced. It
14 controls, and this witness' understanding of what the
15 sale was is not relevant. The best evidence is the
16 contract itself. Also lack of foundation.

17 Q. (By Ms. Herdina) Well, do you know?
18 And aside from what the agreement says, I have the
19 right to ask you this question. If you don't know,
20 you don't know. What was your understanding? You
21 were the plant supervisor. You were the number one
22 man in that plant. What was your understanding as to
23 who owned the Barton process equipment on January 1,
24 1977?

25 A. It was my understanding that it was

1 being operated by NL personnel. And I presumed they
2 still owned it, although I do not know positively.

3 Q. Do you know why the Barton process
4 equipment was still being run by NL?

5 A. No, I do not.

6 Q. Did you ever ask anybody?

7 A. Nope. No, ma'am.

8 Q. Now, at the time that the plant was
9 sold to ILT, the white lead process was no longer
10 running; is that correct?

11 A. That's correct.

12 Q. What happened, if anything, to the
13 equipment that had been used in the white lead process
14 in 1977?

15 A. Over the period of time, a lot of it
16 had been dismantled and taken out. A lot of it was
17 still in place in the plant.

18 Q. On, let's say, January 1, 1977, to the
19 best of your recollection, what equipment from the
20 Carter processor, white lead process, was still in the
21 plant?

22 A. I believe the blow drum. I don't think
23 you'll use that definition, but the pulverized lead --
24 let me show you. I'm looking for the nomenclature you
25 have. I call it the blow drum. You call it a

Attachment 3

**Cited Pages From the Deposition of Roger N. Cieslik
Given on April 30, 1992**

(46, 47, 48, and 49)

1 case, so I don't know if this was one of my -- if
2 I would have been there myself anyway or it was
3 just when they came. I don't recall how I
4 actually was there when they did the sampling.

5 Q. These scavengers you mentioned, what were
6 they doing on the property?

7 A. Dismantling pipes, bag house metal, beams,
8 beams, scrap iron, whatever they could -- whatever
9 metal they could glean from the property.

10 Q. Was it your understanding at the time
11 that those scavengers were authorized to be there
12 by the current property owner?

13 A. I --

14 MS. MARTIN: I'm sorry, I was writing and I
15 didn't hear the question. Could you repeat it or
16 read it back?

17 MR. OSLAN: I can repeat it.

18 BY MR. OSLAN:

19 Q. Was it your understanding that the
20 scavengers were on the property with the
21 permission of the property owner?

22 A. At some point in time that fact was
23 brought to my attention or that fact was alleged
24 by the scavengers.

005517

VICTORIA COURT REPORTING SERVICES, INC.

1 Q. The scavengers told you that they were
2 authorized to be there? ~~known~~

3 A. They told me -- they explained a story to
4 me that the owner had started to demolish the
5 building with a wrecking company, Wrip Wrecking,
6 and that he had run out of money and they had
7 stopped demolishing the building, and the owner
8 told them they can go ahead and take the rest of
9 the building down themselves, but I don't know
10 exactly when that conversation took place.

11 Q. But it was sometime after --

12 A. After the 13th.

13 Q. Of May 1986?

14 A. Right, and then I just pursued the fact
15 that if you continued to do this you're going to
16 end up in the hospital and you're probably going
17 to have your family in the hospital with you, and
18 it took awhile but we narrowed it down so when I
19 would come over I would very seldom see any of the
20 people I was familiar with scavenging the
21 property.

22 Q. What was the concern you had about the
23 property at that time?

24 A. Well, it appeared to us that the people

C02E18

VICTORIA COURT REPORTING SERVICES, INC.

1 that had gotten sick and gone to Cook County
2 Hospital for treatment after an initial review of
3 their home, that the source of the problem was
4 something other than their home and that the
5 individual's only activity outside of the home
6 that we could determine at that time was at the
7 Dutch Boy site. We assumed that the problem was
8 coming from there and we didn't want them doing it
9 anymore until we further assessed the site.

10 Q. Was there a particular condition at the
11 property that you assumed was somehow related to
12 these health problems?

13 A. Well, it seems to me either the first or
14 the second time I found them there they were using
15 an acetylene torch to cut up the bag house pipes.

16 Q. I'm sorry, to cut up what?

17 A. The duct work from the vacuum bag house
18 system.

19 Q. What was it about that activity that
20 caused you some concern?

21 A. That equipment was heavily encrusted with
22 this white powder that I had mentioned earlier,
23 and just as a wild guess I thought it might be
24 lead-bearing paint pigment.

002519

VICTORIA COURT REPORTING SERVICES, INC.

1 Q. And your concern was that they were being
2 exposed to the lead in this white powder?

3 A. Well, the fumes that would come up. They
4 were obviously vaporizing this powder.

5 Q. The combination of using the torch in
6 conjunction with the white powder was the concern
7 you had at the time?

8 A. Right. Lead poisoning is either
9 ingestion or inhalation.

10 Q. Were there any other substances on the
11 property that raised a health concern in your
12 mind?

13 A. Not that I had observed as of that period
14 of time.

15 Q. So in May of 1986 the concern you had
16 about the property was lead; is that correct?

17 A. Lead and asbestos in those first -- say
18 that first week.

19 Q. Did the condition of the property change
20 from your first visit on May 15 of 1986 to the
21 second visit with IEPA?

22 A. Minimally. That would have been a day or
23 two I believe.

24 Q. How many samples did IEPA take on that

CG1320

VICTORIA COURT REPORTING SERVICES, INC.

From: EDWARD KANLON
To: GREGORY.CIURELI.MATTOX-JOAN
Date: 1/19/96 9:37am
Subject: info in the mail

Joan, regarding the copy of the 6/15/94 Harza sampling report and 8/28/95 site assessment reports parts 1 and 2 I sent to your attention yesterday via FEDX, the following helps to summarize some of the sampling FYI:

In 1994, the City of Chicago took thirteen scrape samples and thirteen wipe samples from wall surfaces within the abandoned mill building on the site. Also, seven soil samples were taken by the City at that time on the site. Seven of the wipe samples and eight of the scrape samples were considered lead-bearing. Of the seven soil samples, one had 1000 ppm and one had 220 ppm lead, with the remaining five samples between 1-10 ppm.

In August 1995, EPA conducted a site assessment and additional sampling on and in the vicinity of the property. Six samples were taken on the facility. These six samples had the following lead levels at the noted depths and locations of sampling: 21,200 ppm, 4" depth next to building; 1,180 ppm, 3" depth in SE corner of property; 1,840, 12" north of building; 2,450, 3" north of oil tanks; 6,820, 3" NW of oil tanks; and 31,700, 8" at the loading docks. In addition, all five of the samples taken off of but in the vicinity of the Dutch Boy site were within background lead exposure levels, with three samples near the Edward White School being at 21, 122, and 274 ppm lead, and two samples on the IH property near the smokestack at 54 and 321 ppm lead.

As discussed yesterday, in their efforts to piece together unit operations at the property and the likelihood of release, ORD and SAIC is also requested to consider the likelihood of whether demolition activities would have been the sole cause of the lead levels noted above at the noted depths, and whether prior industrial activities on the property could solely have caused the release.

CG: chris

Attachment 5

**One Page Statement by Frank Cunio, Mark Cunio,
Roy Achurra, James McShane, and Hugh Cameron**

Statement of

FRANK CUNICO

1. My name is Frank Cunico; I am 74 years old and I live at 124 Merry in New Lenox, Illinois 60450.
2. I worked for NL and ARTRA from 1957 through 1980 as an electrical maintenance man. My duties included: repairing electric motors on machines, making modifications to electrical equipment, maintaining lights and exhaust fans, installing emergency lights, and fixing electrical components on the dust collectors.
3. The lead oxide department operated around the clock except for Monday mornings when the machines would be cleaned.
4. There was usually lead dust in the air at the oxide plant. There were often spills from the lead conveyor and even after clean-up dust would remain. Lead leaked from the machinery. Dust collector bags would sometimes burn and lead dust would be released into the air.
5. Blood tests were taken every month and some urine samples as well.
6. Leaded wastewater was washed into pools in the basement where sulfuric acid and lime would be placed on top. The waste in the basement would be pumped out into tank trucks.
7. When NL sold the building to ARTRA (ELT) in 1976, equipment, such as conveyor screws and cylinders, were removed from the oxide department.
8. When ARTRA left the facility in 1980 there was lead left on the site. Lead filled the cracks and pores on the floor of the lead oxide building.

Date:

November 14, 1993

Frank Cunico
Frank Cunico

FC 000001

0000100

Statement of

MARK CUNICO

1. My name is Mark Cunico; I am 38 years old and I live at 40 Arlington Drive in Romeoville, IL.
2. I worked at the Carter/Dutch Boy plant from 1975-1978 as a batch maker and case sealer, filling drums and trucks and I also worked in the Oxide Department.
3. When I worked there, the Carter Plant was old and lead dust was visible throughout the plant, especially on the beams. The dust was so thick that I could write my name in it.
4. I cleaned drums and in the process would get lead on me to the point where I could taste it.
5. Apart from occasional blood tests, there were no health or safety programs for the workers.
6. I don't remember being told by anyone at the plant that lead dust was dangerous.
7. I was tested for lead poisoning and at one was point found to have an elevated blood lead level.
8. The wearing of safety equipment, such as gloves and respirators, was not mandatory.
9. Several workers were "leaded" during the time I worked there.
10. Neither NL nor ARTRA implemented a safety program.
11. I recall no environmental clean-up at the plant under either NL or ARTRA.

Date:

5-18-95

Mark L. Cunico
Mark Cunico

mc 000001

STATE BY: SPIC CINTL DA 05203 2-18-95 11:20 5137232605

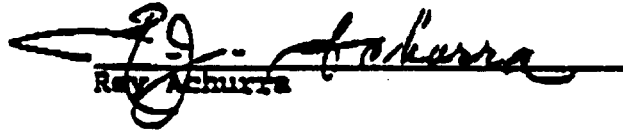
Statement of

REY ACHURRA

1. My name is Rey Achurra; I am 65 years old and I live at 6936 Springside Avenue, Downers Grove, IL 60516.
2. I worked at the Carter/Dutch Boy plant from 1968-1979 as a chemist involved in quality control and research and development.
3. During the time I worked there, the plant was old and lead dust was visible throughout the plant.
4. Safety measures consisted of clothing, respirators and gloves. There were no meetings, training or handbooks provided on worker safety or the hazards of lead.
5. I remember one lead dust exposure case.
6. The same conditions were present after NL sold the plant to ELT in 1976.

Date:

5-18-95


Rey Achurra

RA 000001

Statement of

JAMES MCSHANE

1. My name is James McShane and I live at 14901 Evers in Dolton, Illinois 60419.
2. I am 71 years old and suffer from what my doctor has diagnosed as lead-related emphysema.
3. I worked at the Carter/Dutch Boy plant from 1956 through 1980 as a painter.
4. Lead dust was so thick in the plant that sometimes I could only see 10 or 15 feet. I knew the dust contained lead but remember no warnings that the lead was hazardous or that there was a risk of lead exposure.
5. I was "leaded" in 1965. I was taken to Mercy Hospital, given a blood test, x-rayed and given pills and released. Jack McCann, a co-worker, was also "leaded".
6. Paint spills occurred often.
7. The plant was a place "where things were taken for granted."
8. I am aware of no clean-up efforts at the plant by either NL or ARTRA.

Date: 5/19/95James McShane
James McShane

JM 000001 -

Statement of

HUGH CAMERON

1. My name is Hugh Cameron; I am 75 years old and I live at 4023 Appleby Lane in Richton Park, Illinois.
2. I worked at the Carter/Dutch Boy plant from 1956 through 1980, primarily in the paint department. I filled and labelled boxes of paint cans, among other duties.
3. There were no meetings, safety training or handbooks regarding the hazards of lead at the plant.
4. Spills of paint and lead occurred often.
5. Lead dust was everywhere inside the plant, particularly on the third floor of the Paint Department.

Date: 2. 26. 95

Hugh Cameron
Hugh Cameron

HC 000001

Attachment 6

**Plant Description With Locations of the Carter Process,
Barton Process, and Mixed Paint Process.
Pages 55 and 56 Plus Exhibit 9
Taken From Deposition of Chester Licking**

1 paint, then we went to a full, complete sprinkler
2 system, all of the buildings.

3 (WHEREUPON, a document was tendered
4 to the witness.)

5 BY MR. RUNNING:

6 Q Mr. Licking, can you identify the blueprint
7 shown on Exhibit 9?

8 A Yes, yes. This is a very good print showing
9 the plant as it existed when I retired.

10 Q Now, in the lower right of the diagram, there
11 is a reference to the oxide department and six Barton
12 pots. Is that the location for the Barton pot process
13 depicted on Exhibit 7?

14 A Yes, that is the area that the Barton pots
15 were in..

16 Q Where was the Carter process operated? The
17 Carter process referring to the process identified in
18 Exhibit 6.

19 A The Carter process referred to in your Exhibit
20 6 was in what's known as building five, section one;
21 building five, section three. Those were the -- where
22 the Carter cylinders were located. What is now marked
23 building five, section two was a six-story gallery
24 building which was primarily for the conveying system.

1 Q And building four, what occurred there?

2 Building four.

3 A Building four is the -- is the building that
4 was used for the mixed paint plant after 1946. That was
5 where the mixed paint plant was installed. That -- that
6 originally had been a storage area for the white lead
7 plant and was not -- since there wasn't enough white
8 lead used anymore, the building was available.

9 Q Mr. Licking, are you familiar with fly
10 dumping, what that term means?

11 A No, I am not.

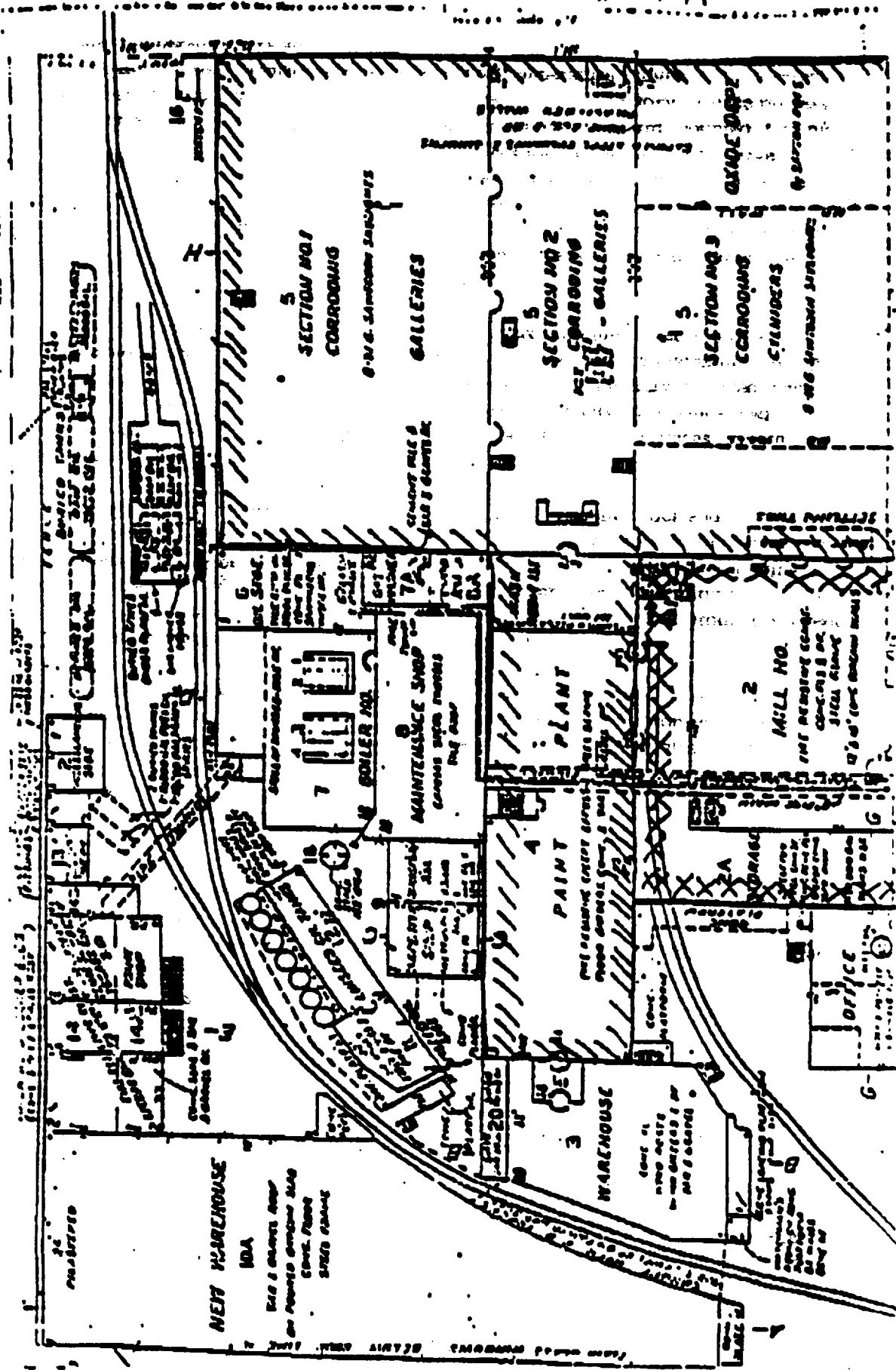
12 Q How about the term midnight dumping?

13 A Yes, I am familiar with midnight dumping from
14 my experience in -- as assessor in my township.

15 Q Well, let's just assume fly dumping means that
16 somebody comes onto a property, trespasses onto it
17 without permission, and dumps something on it and leaves
18 without permission again. Or midnight dumping, the same
19 connotation. Was there any fly dumping or midnight
20 dumping taking place on the property from 1929 to 1971?

21 A No, no, there was not. The site for the plant
22 was closed off at the north with an eight-foot wire
23 fence with a gate with barbed wire on top.

24 The other opening -- only other opening



Attachment 7

Carter Process Description Exhibit 6

**Taken From Deposition of Chester Licking and Final Product Description
Page 120 of the Clarence Smith Deposition**

Clarene Smith

120

1 oil.

2 Q. What was the consistencies? Can you
3 compare it to anything?

4 A. Very stiff. It would stand up by
5 itself in a cone.

6 Q. How was it packaged? Can you describe
7 that for me?

8 A. We packaged it into -- back up a
9 minute. Consistencies depended on -- we made two
10 different types, and the type was only the amount of
11 oil we added to it. With a heavy paste or regular
12 paste, the heavy paste had less linseed oil. It was a
13 matter of proportion.

14 The soft paste or lighter paste that
15 was packaged in 100-, 50-, and 25-pound kegs.

16 Q. Okay.

17 A. The heavy one was packaged in 1- and 5-
18 pound tins. Plumbers used it for pipe dope.

19 Q. That's what I was going to ask you
20 next. What was the soft paste used for?

21 A. The soft paste, when it was sold to the
22 public, this was converted by the customer into a
23 paint. They would add additional oil and thinner to
24 it, mineral spirits, and make a paint out of it, bring
25 it down consistent with a paint.

Attachment 8

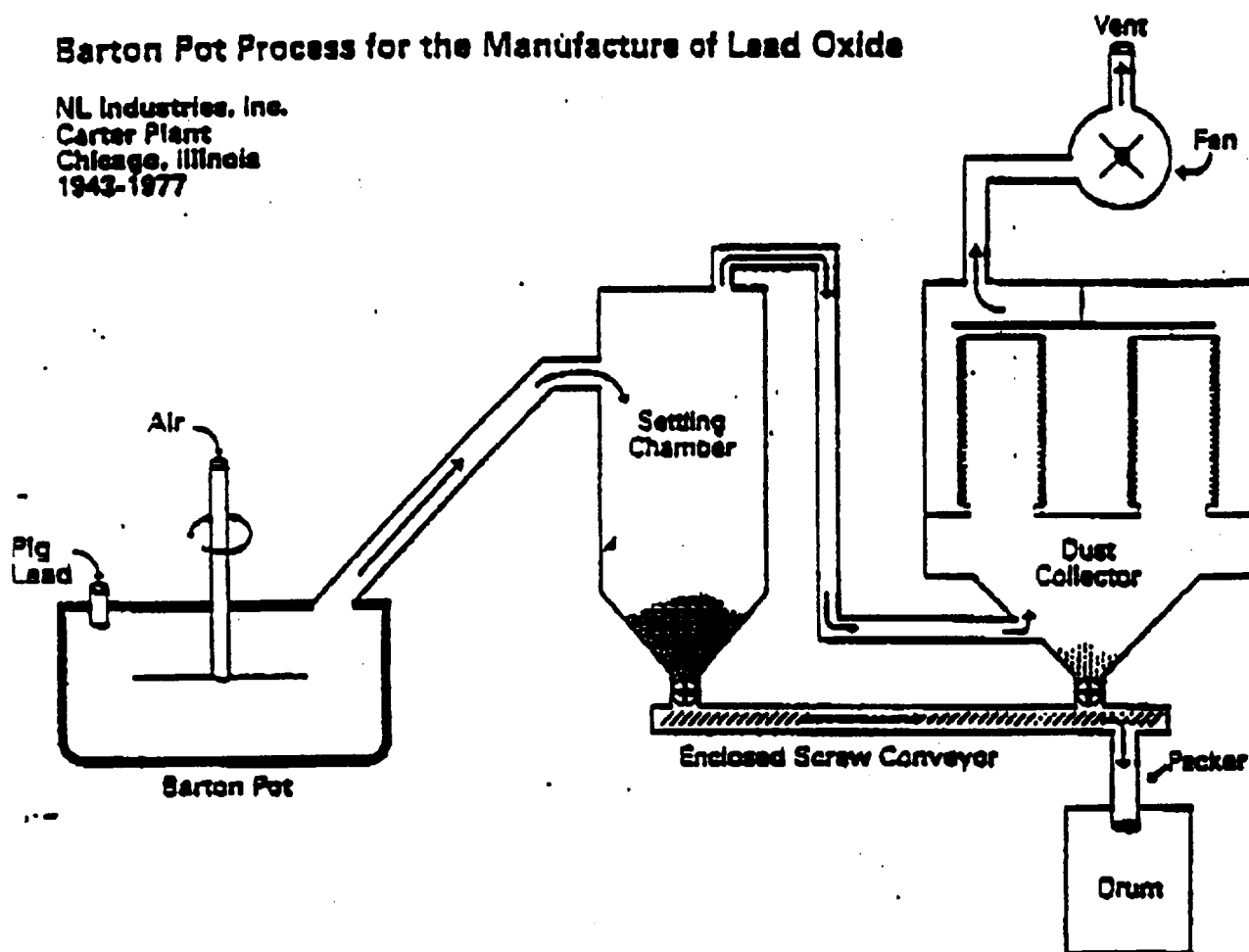
Barton Pot Process Description Exhibit 7

Taken From Deposition of Chester Licking and Final Product Description

Page 89 of the Clarence Smith Deposition

Barton Pot Process for the Manufacture of Lead Oxide

NL Industries, Inc.
Carter Plant
Chicago, Illinois
1943-1977



Licking DER EX NO 7
FOR ID. AS OF 2-24-92

CLARENCE SMITH

89

1 Q. Were the dust collectors that were used
2 in the mixed-paint process -- were those DRACCO dust
3 collectors?

4 A. I believe all of them were Dracos.
5 DRACCO was merely a company who manufactures them --

6 Q. Right.

7 A. -- not really a type.

8 Q. Let's talk about the lead oxide process
9 or production part of the plant that existed in
10 December of 1976. Okay?

11 A. Okay.

12 Q. Now, I believe you talked about -- you
13 referred to that as the Barton process; is that
14 correct?

15 A. Right.

16 Q. You earlier testified that the end
17 product was a grayish-brown powder that was used in
18 car batteries; is that correct?

19 A. Yes. Some industrial batteries also.

20 Q. Okay. What what would the grayish-
21 brown powder be made up of?

22 A. Lead oxide and a small percentage of
23 metallic lead.

24 Q. Let me start with the production end of
25 things. In 1976, do you know the volume of lead oxide

NOTICE

The Emission Factor And Inventory Group (EFIG) has been working for several months on this Fifth Edition of AP-42. It is the result of a major technical undertaking by EFIG's AP-42 Team and the several contractors who assisted. This document represents a substantial step toward complying with Section 130 of the Clean Air Act Amendments Of 1990, which direct the U. S. Environmental Protection Agency to review and revise its air pollutant emission factors every three years. Although such updating is required only for ozone-related pollutants (total organic compounds, oxides of nitrogen, and carbon monoxide), the AP-42 Team has also addressed the other criteria pollutants, hazardous pollutants, global warming gases and speciation information, where data are available. Sections of AP-42 are continuously being developed, reviewed and/or updated.

Even though there are significant additions and improvements in this book, many data gaps and uncertainties still exist. All readers and users of AP-42 are asked to provide comments, test data, and any other information for our evaluation and possible use to improve future updates.

Users familiar with this document may notice changes in factor quality ratings, specifically that some factors, although unchanged or supported by even newer and more extensive data, are rated lower in quality than previously in the AP-42 series. This is attributable to the adoption of more consistent and stringently applied rating criteria. There are some factors in this edition with lower ratings than previously, but they are believed to represent appropriate estimates. AP-42 emission factors are truly for estimation purposes and are no substitute for exact measurements taken at a source.

Users should especially note this edition's expanded "Introduction", for its information on pollutant definition, factor limitations, the factor rating system, and cautionary notes on the use of factors for anything other than emission estimation and inventory and approximation purposes.

In addition to print, the AP-42 series is available in several other media. The Air CHIEF compact disc (CD-ROM), with AP-42 and other hazardous air pollutant emission estimation reports and data bases, can be purchased from the Government Printing Office. Also, The CHIEF electronic bulletin board (by modem, 919-541-5143) posts the latest AP-42 and other reports and tools before they are available on paper. Final sections of AP-42 can be obtained quickly from our automatic Fax CHIEF service (919-541-5628 or -0548). These last two media operate 24 hours per day, 7 days per week. If you have questions or need further information on these tools or other aspects of emission estimation, call our help line, Info CHIEF, at 919-541-5285, during regular office hours, eastern time.

If you have factor needs, new data, questions, or suggestions, please send them to the address below. You may also ask for a free subscription to The CHIEF, our quarterly newsletter (also on the electronic bulletin board and Fax CHIEF). Our abilities to respond to individual questions often get impinged by time and resource constraints and the sheer volume of requests, so please use the above capabilities and tools whenever possible. Though we are a client-oriented organization, we have neither staff nor structure to provide engineering support.

AP-42 Team (MD 14)
Emission Factor And Inventory Group
Emissions, Monitoring, And Analysis Division
Office Of Air Quality Planning And Standards
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711

12.16 Lead Oxide And Pigment Production

12.16.1 General^{1-2,7}

Lead oxide is a general term and can be either lead monoxide or "litharge" (PbO); lead tetroxide or "red lead" (Pb₃O₄); or black or "gray" oxide which is a mixture of 70 percent lead monoxide and 30 percent metallic lead. Black lead is made for specific use in the manufacture of lead acid storage batteries. Because of the size of the lead acid battery industry, lead monoxide is the most important commercial compound of lead, based on volume. Total oxide production in 1989 was 57,984 megagrams (64,000 tons).

Litharge is used primarily in the manufacture of various ceramic products. Because of its electrical and electronic properties, litharge is also used in capacitors, Vidicon[®] tubes, and electrophotographic plates, as well as in ferromagnetic and ferroelectric materials. It is also used as an activator in rubber, a curing agent in elastomers, a sulfur removal agent in the production of thioles and in oil refining, and an oxidation catalyst in several organic chemical processes. It also has important markets in the production of many lead chemicals, dry colors, soaps (i. e., lead stearate), and driers for paint. Another important use of litharge is the production of lead salts, particularly those used as stabilizers for plastics, notably polyvinyl chloride materials.

The major lead pigment is red lead (Pb₃O₄), which is used principally in ferrous metal protective paints. Other lead pigments include white lead and lead chromates. There are several commercial varieties of white lead including leaded zinc oxide, basic carbonate white lead, basic sulfate white lead, and basic lead silicates. Of these, the most important is leaded zinc oxide, which is used almost entirely as white pigment for exterior oil-based paints.

12.16.2 Process Description⁸

Black oxide is usually produced by a Barton Pot process. Basic carbonate white lead production is based on the reaction of litharge with acetic acid or acetate ions. This product, when reacted with carbon dioxide, will form lead carbonate. White leads (other than carbonates) are made either by chemical, fuming, or mechanical blending processes. Red lead is produced by oxidizing litharge in a reverberatory furnace. Chromate pigments are generally manufactured by precipitation or calcination as in the following equation:



Commercial lead oxides can all be prepared by wet chemical methods. With the exception of lead dioxide, lead oxides are produced by thermal processes in which lead is directly oxidized with air. The processes may be classified according to the temperature of the reaction: (1) low temperature, below the melting point of lead; (2) moderate temperature, between the melting points of lead and lead monoxide; and (3) high temperature, above the melting point of lead monoxide.

12.16.2.1 Low Temperature Oxidation -

Low temperature oxidation of lead is accomplished by tumbling slugs of metallic lead in a ball mill equipped with an air flow. The air flow provides oxygen and is used as a coolant. If some form of cooling were not supplied, the heat generated by the oxidation of the lead plus the mechanical heat of the tumbling charge would raise the charge temperature above the melting point of lead. The ball mill product is a "leady" oxide with 20 to 50 percent free lead.

12.16.2.2 Moderate Temperature Oxidation

Three processes are used commercially in the moderate temperature range: (1) refractory furnace, (2) rotary tube furnace, and (3) the Barton Pot process. In the refractory furnace process, a cast steel pan is equipped with a rotating vertical shaft and a horizontal crossarm mounted with plows. The plows move the charge continuously to expose fresh surfaces for oxidation. The charge is heated by a gas flame on its surface. Oxidation of the charge supplies much of the reactive heat as the reaction progresses. A variety of products can be manufactured from pig lead feed by varying the feed temperature, and time of furnacing. Yellow litharge (orthorhombic) can be made by cooking for several hours at 600 to 700°C (1112 to 1292°F) but may contain traces of red lead and/or free metallic lead.

In the rotary tube furnace process, molten lead is introduced into the upper end of a refractory-lined inclined rotating tube. An oxidizing flame in the lower end maintains the desired temperature of reaction. The tube is long enough so that the charge is completely oxidized when it emerges from the lower end. This type of furnace has been used commonly to produce lead monoxide (tetragonal type), but it is not unusual for the final product to contain traces of both free metallic and red lead.

The Barton Pot process (Figure 12.16-1) uses a cast iron pot with an upper and lower stirrer rotating at different speeds. Molten lead is fed through a port in the cover into the pot, where it is broken up into droplets by high-speed blades. Heat is supplied initially to develop an operating temperature from 370 to 480°C (698 to 896°F). The exothermic heat from the resulting oxidation of the droplets is usually sufficient to maintain the desired temperature. The oxidized product is swept out of the pot by an air stream.

The operation is controlled by adjusting the rate of molten lead feed, the speed of the stirrers, the temperature of the system, and the rate of air flow through the pot. The Barton Pot produces either litharge or leady litharge (litharge with 50 percent free lead). Since it operates at a higher temperature than a ball mill unit, the oxide portion will usually contain some orthorhombic litharge. It may also be operated to obtain almost entirely orthorhombic product.

12.16.2.3 High Temperature Oxidation

High temperature oxidation is a fume-type process. A very fine particle, high-purity orthorhombic litharge is made by burning a fine stream of molten lead in a special blast-type burner. The flame temperature is around 1200°C (2192°F). The fume is swept out of the chamber by an air stream, cooled in a series of "goose-necks" and collected in a baghouse. The median particle diameter is from 0.50 to 1.0 micrometers, as compared with 3.0 to 16.0 micrometers for lead monoxide manufactured by other methods.

12.16.3 Emissions And Controls^{3-4,6}

Emission factors for lead oxide and pigment production processes are given in Tables 12.16-1 and 12.16-2. The emission factors were assigned an E rating because of high variabilities in test run results and nonisokinetic sampling. Also, since storage battery production facilities produce lead oxide using the Barton Pot process, a comparison of the lead emission factors from both industries has been performed. The lead oxide emission factors from the battery plants were found to be considerably lower than the emission factors from the lead oxide and pigment industry. Since lead battery production plants are covered under federal regulations, one would expect lower emissions from these sources.

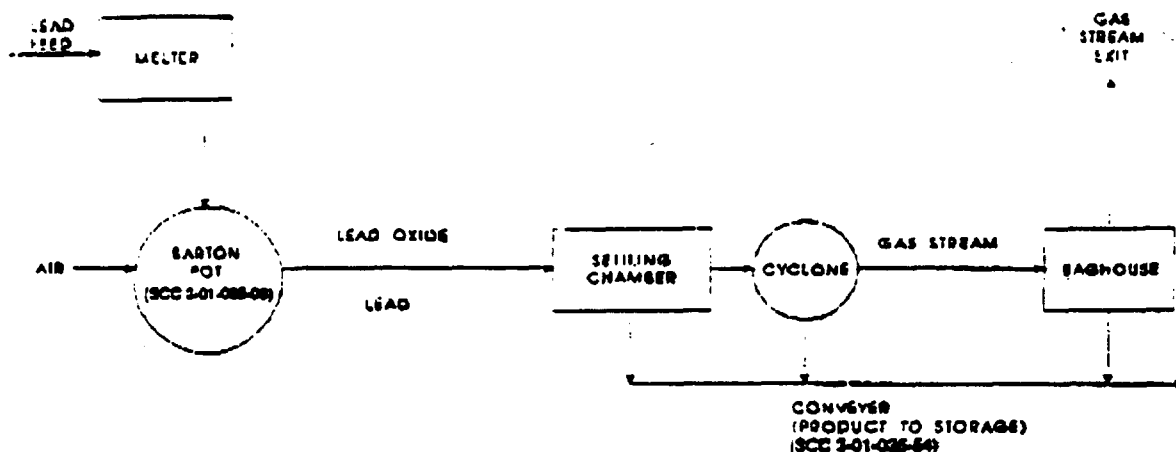


Figure 12.16-1. Lead oxide Barton Pot process.
(Source Classification Codes in parentheses.)

Automatic shaker-type fabric filters, often preceded by cyclone mechanical collectors or settling chambers, are the common choice for collecting lead oxides and pigments. Control efficiencies of 99 percent are achieved with these control device combinations. Where fabric filters are not appropriate, scrubbers may be used to achieve control efficiencies from 70 to 95 percent. The ball mill and Barton Pot processes of black oxide manufacturing recover the lead product by these 2 means. Collection of dust and fumes from the production of red lead is likewise an economic necessity, since particulate emissions, although small, are about 90 percent lead. Emissions data from the production of white lead pigments are not available, but they have been estimated because of health and safety regulations. The emissions from dryer exhaust scrubbers account for over 50 percent of the total lead emitted in lead chromate production.

Table 12.16-1 (Metric Units). CONTROLLED EMISSIONS FROM LEAD OXIDE AND PIGMENT PRODUCTION^a

Process	Particulate		Lead		References
	Emissions	EMISSION FACTOR RATING	Emissions	EMISSION FACTOR RATING	
Lead Oxide Production					
Barton Pot ^b (SCC 3-01-035-06)	0.21 - 0.43	E	0.22	E	4,6
Calcining (SCC 3-01-035-07)					
Baghouse Inlet	7.13	E	7.00	E	6
Baghouse Outlet	0.032	E	0.024	E	6
Pigment Production					
Red lead ^b (SCC 3-01-035-10)	0.5 ^c	B	0.50	B	3
White lead ^b (SCC 3-01-035-15)	ND	NA	0.28	B	4,5
Chrome pigments (SCC 3-01-035-20)	ND	NA	0.065	B	4,5

^a Factors are for kg/Mg of product. SCC = Source Classification Code. ND = no data. NA = not applicable.

^b Measured at baghouse outlet. Baghouse is considered process equipment.

^c Only PbO and oxygen are used in red lead production, so particulate emissions are assumed to be about 90% lead.

Table 12.16-2 (English Units). CONTROLLED EMISSIONS FROM LEAD OXIDE AND PIGMENT PRODUCTION^a

Process	Particulate		Lead		References
	Emissions	EMISSION FACTOR RATING	Emissions	EMISSION FACTOR RATING	
Lead Oxide Production:					
Barton Pot ^b (SCC 3-01-035-06)	0.43 - 0.85	E	0.44	E	4,6
Calcining (SCC 3-01-035-07)					
Baghouse Inlet	14.27	E	14.00	E	6
Baghouse Outlet	0.064	E	0.05	E	6
Pigment Production:					
Red lead ^b (SCC 3-01-035-10)	1.0 ^c	B	0.90	B	4,5
White lead ^b (SCC 3-01-035-15)	ND	NA	0.55	B	4,5
Chrome pigments (SCC 3-01-035-20)	ND	NA	0.13	B	4,5

^a Factors are for lb/ton of product. SCC = Source Classification Code. ND = no data.
NA = not applicable.

^b Measured at baghouse outlet. Baghouse is considered process equipment.

^c Only PbO and oxygen are used in red lead production, so particulate emissions are assumed to be about 90% lead.

References For Section 12.16

1. E. J. Ritchie, *Lead Oxides*, Independent Battery Manufacturers Association, Inc., Largo, FL, 1974.
2. W. E. Davis, *Emissions Study Of Industrial Sources Of Lead Air Pollutants*, 1970. EPA Contract No. 68-02-0271, W. E. Davis And Associates, Leawood, KS, April 1973.
3. *Background Information In Support Of The Development Of Performance Standards For The Lead Additive Industry*, EPA Contract No. 68-02-2085, PEDCo Environmental Specialists, Inc., Cincinnati, OH, January 1976.
4. *Control Techniques For Lead Air Emissions*, EPA-450/2-77-012A. U. S. Environmental Protection Agency, Research Triangle Park, NC. December 1977.
5. R. P. Betz, *et al.*, *Economics Of Lead Removal In Selected Industries*, EPA Contract No. 68-02-0299, Battelle Columbus Laboratories, Columbus OH, December 1972.

6. **Air Pollution Emission Test, Contract No. 74-PB-0-1, Task No. 10, Office Of Air Quality Planning And Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC, August 1973.**
7. **Mineral Yearbook, Volume I: Metals And Minerals, Bureau Of Mines, U. S. Department Of The Interior, Washington, DC, 1989.**
8. **Harvey E. Brown, Lead Oxide: Properties And Applications, International Lead-Zinc Research Organization, Inc., New York, NY, 1985.**

AIR AND RADIATION

CLEARINGHOUSES

EMISSION FACTOR CLEARINGHOUSE

Address: U.S. Environmental Protection Agency
Emission Inventory Branch, MD-14
Research Triangle Park, NC 27711

Telephone: Clearinghouse
(919) 541-5477
The CHIEF Bulletin Board
By modem 1200, 2400, or 9600 baud equipment
(919) 541-5742

Fax: (919) 541-0684

Primary Contacts: Clearinghouse—Info CHIEF
(919) 541-5285
The CHIEF Newsletter—Whitney M. Joyner
(919) 541-5493
The CHIEF Bulletin Board—Michael Hamlin
(919) 541-5232
Air CHIEF Compact Disc—Anne Pope
(919) 541-5373
General Information—Info CHIEF Hotline
(919) 541-5285

Hours: 8:00 a.m. - 4:30 p.m.
Monday - Friday

Time Zone: Eastern

Subject Emphasis: Air pollutant emission factors and estimation tools for criteria and toxic pollutants from stationary and area sources, as well as mobile sources.

Description of Services: The Clearinghouse is a means of exchanging information on air pollution control matters, between and among federal, state and local pollution control agencies, private citizens, universities, contractors, and foreign governments. It addresses the criteria pollutants (Particulate/PM-10, Total Organic Compounds, SO₂, NO_x, CO, and Lead) and toxic substances from stationary and area sources, as well as mobile sources.

AIR AND RADIATION

Audience: Full information about the Clearinghouse for inventories and emission factors, and any of its aspects mentioned here is available to anyone who requests it.

Sponsoring EPA Office: Technical Support Division, Office of Air Quality Planning and Standards

Publications: *The CHIEF Newsletter*. This newsletter is issued quarterly, and it contains:

- Information on newly developed emission factors or inventory procedures which may not yet have been printed and distributed.
- News of recent publications of use to its readers, with information on how to obtain them and with the name of a knowledgeable contact on the subjects.
- Information on obtaining PC programs useful in estimating or inventorying air pollutant emissions.
- Requests from government elements or from individual readers for assistance in dealing with general or specific air pollution emissions.
- Inquiries about EPA emission inventory policy and guidance.
- Other items deemed of interest to readers and to the issuing office.

The Newsletter is accompanied in its efforts at information exchange by the Clearinghouse For Inventories and Emission Factors (the CHIEF) electronic bulletin board. The Newsletter and the CHIEF are available to anyone who contacts the sponsoring office and asks for access to them. Present circulation of the Newsletter is about 5,000.

Clearinghouse Databases: Clearinghouse for Inventories and Emission Factors (CHIEF) electronic bulletin board. Requirements for access to the CHIEF are a computer, a communications software package, and a modem with parameters set at 8 data bits, 1 stop bit, and 0 parity. The CHIEF contains emissions databases (including some toxics information), bulletins, messages, copies of all past Newsletters, and Email services. Major files include the *Compilation of Air Pollutant Emission Factors* (AP-42) series; SPECLATE, with speciation factors for photochemical or receptor modeling; TANKS, PC calculation software which will estimate emissions from organic liquid storage tanks; FIRE, a PC database management system containing criteria and toxics emission factors; SIMS, the Surface Impoundment Modeling System; and AFSEF, with access to AIRS Facility Subsystem Emission Factors. The CHIEF bulletin board hours are

24hours

AIR AND RADIATION

hours per day, except Mondays 8:00 a.m. to noon for maintenance. Many of reports and databases on the CHIEF electronic bulletin board are also found on the Air CHIEF CD ROM.

CLEARINGHOUSES

CLEARINGHOUSES

MARGARET M. GROEBER**EDUCATION:**

University of Cincinnati: B.S.M.E., Mechanical Engineering (1979)
 University of Cincinnati: M.S. Environmental Engineering (1991)

SUMMARY OF EXPERIENCE

Ms. Groeber has fourteen years of experience in the environmental field. Her previous experience includes six years with local government, including three years at a regulatory agency. She has been involved in a wide range of environmental projects including hazardous waste incineration, fossil-fuel combustion, air quality planning, and regulatory analysis.

Ms. Groeber has extensive involvement with the Superfund Innovative Technology Evaluation (SITE) Demonstration contract. She was the Work Assignment Manager (WAM) on several projects in which she was responsible for test plan development, field testing, report writing, and all other management and technical aspects.

EMPLOYMENT HISTORY

Present Position: Science Applications International Corporation (SAIC)

Ms. Groeber is WAM for three projects under EPA's Technical Support Contract including the RCRA Corrective Action, the Solucorp Demonstration, and the Metal Remediation Engineering Bulletin work assignments.

Ms. Groeber was WAM for a SITE Demonstration project which evaluated the performance of KAT's RPH soil decontamination system at Kelly AFB in San Antonio, Texas. This demonstration was performed under a Memorandum of Understanding between EPA SITE and Air Force's contractor.

Ms. Groeber was WAM for the EPA RREL's Mobile Volume Reduction Unit SITE Demonstration project conducted at the Hecambia Wood Treating Company Superfund site in Pensacola, Florida. The demonstration evaluated the ability of the VRU to reduce the amount of hazardous waste requiring disposal at Superfund sites.

Ms. Groeber was WAM for the Babcock and Wilcox (B&W) SITE Demonstration Project conducted at B&W's research facility in Alliance, Ohio. The demonstration evaluated the performance of the B&W system for the treatment of hazardous soils. The technology was demonstrated using a synthetic soil matrix (SSM) provided by EPA, RREL.

Ms. Groeber was the field manager for the Process Technology Inc. (PTI) SITE demonstration conducted at McClellan AFB as part of the McClellan Public-Private Partnership. This demonstration tried to evaluate PTI's photolytic destruction technology. Ms. Groeber was responsible for coordinating field activities including subcontractor involvement in specialized air sampling procedures and analysis of non-routine contaminants such as dioxin, phosgene, and hydrogen fluoride.

Verified for Accuracy By: Margaret M. Groeber Date: 1-31-96

Ms. Groeber was the field manager for the Clean Berkshire, Inc. SITE Demonstration project, which was conducted at Niagara Mohawk's Harbor Point site in Utica, New York. Ms. Groeber was responsible for coordinating subcontractor air sampling activities. She also has provided technical and field support for the Aprtek and Bergmann USA projects.

Ms. Groeber was WAM for the work assignment entitled "Workshops on Improving Drinking Water Facilities Using the Composite Correction Program Approach." A series of three workshops were presented by SAIC and its subcontractor for EPA, Center for Environmental Research Information and Technical Support Division. Ms. Groeber worked with the subcontractor to present the technical program. She also prepared proceedings from each workshop and a project summary report in conjunction with the subcontractor and the workshop facilitator. Ms. Groeber also conducted a workshop on pesticide disposal for EPA-RREL. Her work included soliciting and selecting papers and preparing workshop proceedings.

Ms. Groeber was a contributing author on the thermal desorption treatability guidance document. She was the primary author on the Granular Activated Carbon and Chemical Oxidation Engineering Bulletins prepared for EPA, RREL. She also served as WAM for this work assignment and contributed to the writing of several other engineering bulletins, including Technology Preselection Data Requirements, Design Considerations for Ambient Air Monitoring at Superfund Sites, Air Pathway Analysis, Solidification/Stabilization of Organics and Inorganics.

Ms. Groeber provided technical assistance on several work assignments dealing with hazardous waste incineration issues for EPA, RREL. She also provided technical assistance on several projects involving metal partitioning from the incineration of both hazardous and municipal solid wastes.

Ms. Groeber provided technical assistance on several EPA Waste Minimization Opportunity Assessments (WMOAs) including Andrew W. Breidenbach Environmental Research Center and Mt. Washington Presbyterian Church. She also participated on the review team for the following: U.S. Coast Guard Support Center, Governors Island, NY; Scott Air Force Base, Belleville, IL; Optical Fabrication Laboratory, Fitzsimmons Army Medical Center, Denver Co; Philadelphia Naval Shipyard, Philadelphia, PA; and Truck Assembly Plant.

Ms. Groeber provided technical assistance for several work assignments providing evaluations of technologies selected at Superfund and RCRA Corrective Action sites. Under this work assignment, these tasks included review of site-specific RI/FS data, recommendations on the applicability of innovative technologies, and recommendations on additional data requirements for treatment technology selection.

July 1987 to July 1990: Ohio-Kentucky-Indiana (OKI) Regional Council of Governments

Ms. Groeber was the Air Quality Coordinator at a transportation planning agency for an area with a population of almost two million. She coordinated the air quality planning process for various federal, state and local agencies. She prepared periodic updates to OKI's Technical Coordinating Committee and Greater Cincinnati's Chamber of Commerce Air Quality Subcommittee. She also provided technical assistance to OKI's Water Quality Management Planning Program which included identification of potential sources of groundwater pollution, implementation of a groundwater protection strategy and land use planning over the region's aquifers.

Verified for Accuracy By: Margaret M. Bohm Date: 1-31-96

July 1984 to June 1987: Southwestern Ohio Air Pollution Control Agency

Ms. Groeber was employed as an Environmental Scientist involved in regulating air contaminant sources in Southwestern Ohio. Her work included review of permit applications, determination of compliance status and writing of permit's special terms and conditions. She conducted annual facility inspections at major and minor sources of air pollution and their associated control equipment. Sources and control devices she inspected included utility and industrial boilers, chemical processing plants, municipal wastewater treatment systems, electrostatic precipitators, baghouses and catalytic oxidation systems. She calculated emissions from these sources and the reductions from the air pollution control equipment. She also observed EPA reference method testing and conducted public hearings. Ms. Groeber also investigated citizen complaints.

November 1979 to September 1982: PEI Associates, Inc.

Ms. Groeber was employed as a Mechanical Engineer working primarily on EPA and DOE funded projects. Much of her work dealt with environmental and engineering problems associated with converting boilers to coal-firing. She developed costs and cost equations for boilers and the associated air pollution control equipment such as electrostatic precipitators, baghouses and flue gas desulfurization systems. Ms. Groeber also was involved in calculating emissions from the iron and steel and non-ferrous industries. She developed an acid rain literature data base and provided technical assistance on the utility flue gas desulfurization survey report.

PROFESSIONAL REGISTRATION/CERTIFICATION

Ms. Groeber is involved with the Air and Waste Management Association. She has served on the Board of Directors for the East Central Section and was past chairman of the Southwest Ohio Chapter of the East Central Section.

TRAINING

40-Hour Health and Safety (OSHA 9610) Training (October 1991)

8-Hour Refresher Training for Hazardous Waste Site Worker (updated annually)

Verified for Accuracy By: Margaret M. Groeber Date: 1-31-96

HOWARD D. FEILER**EDUCATION**

Pennsylvania State University, M.S., Environmental Pollution Control (1973)
State University of New York, (Binghamton), B.A., Chemistry (1970)

SUMMARY OF EXPERIENCE

Mr. Feiler is Corporate Vice President and Manager of SAIC's Environmental Technology R&D Department. For over twenty years, Mr. Feiler has specialized in hazardous waste treatment and industrial and municipal pollution control. During this time, he has managed major programs to evaluate innovative and emerging technologies, develop Federal effluent guidelines and pretreatment standards, supervised field sampling programs, designed treatment facilities, developed municipal/industrial pretreatment and permitting programs, and evaluated advanced waste treatment methods, among many others. Mr. Feiler has expertise in project management, laboratory analysis, field work, design studies, POTW operation and maintenance and technology evaluation.

Currently, Mr. Feiler serves as Program Manager for SAIC's contract with EPA RREL in Cincinnati to support the Superfund Innovative Technology Evaluation (SITE) program. Under this \$29 million 5 year contract, which is the reissuance of our earlier \$26 million 3 year SITE contract, Mr. Feiler is responsible for technology demonstrations and evaluation of innovative and emerging processes ranging from critical fluid extraction to plasma arc incineration and biodegradation of hazardous wastes. The goal of the SITE program is to aid in the commercialization of innovative processes for the permanent clean-up of NPL sites.

Mr. Feiler also recently served as Project Manager for a R&D contract with the DOE Argonne National Laboratory. Under this contract, algae based ion exchange materials are being evaluated for application to clean up of contaminated groundwaters at DOE sites. Groundwater containing uranium, chromium and mercury have been successfully treated under this program.

Mr. Feiler is Corporate Officer-in-Charge for two contracts with EPA's Engineering and Analysis Division (EAD). This work relates to development of best practicable treatment control technology (BPT) and best available technology (BAT) for the Organic Chemicals and Plastics and Synthetic Fibers Industries (OCPSF) and the Petroleum Industry. A recent new assignment has been the start-up of a study of the Hazardous Waste Treatment Industry. Activities associated with this work include: data analysis, field sampling, 306 questionnaire development and Development Document preparation.

Verified for accuracy by:

Howard D. Feiler
Howard D. Feiler

Date: 3/1/95

An Employee-Owned Company

JAN 30 '95 04:27PM SAIC/ETW

P.3/5

Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal or quotation.

HOWARD D. FEILER

Page 2 of 4

Other tasks managed by Mr. Feiler on the EAD project have included preparation of the public and confidential records and EPA computer model cost development as well as assistance to EPA in developing the regulatory rulemaking packages.

Mr. Feiler was previously the Engineering Project Leader for an Air Force contract entitled "Field Evaluation and Sample Collection and Analysis for Water, Wastewater, Solid Waste Evaluation/Investigation." This program spans 4 years and is valued at \$9.5 million. Under this contract, SAIC provides Phase I and II site investigation services under the Air Force's Installation Restoration Program (IRP).

Earlier in his SAIC career, Mr. Feiler maintained oversight of SAIC's Permit Assistance and POTW Diagnostic projects currently underway for EPA's Office of Water Enforcement. Additionally, Mr. Feiler was the Project Director for SAIC's contract with the NJDEP Statewide Pretreatment Management Program. Mr. Feiler also served as Project Manager for an effort to prepare preliminary assessments of hazardous waste disposal sites and also acted as Project Director for a research project to develop early warning mechanisms for upset anaerobic digestion processes.

Prior to joining SAIC, Mr. Feiler was Project Manager for a major EPA project to determine the Fate of Toxic Priority Pollutants in Publicly Owned Treatment Works (POTWs). The project, funded by the EPA Industrial Technology Division, encompassed sampling at approximately 40 POTWs with subsequent analysis for the 129 priority pollutants. The processes and special characteristics of each POTW were evaluated in preparation for round-the-clock sampling over a one-week period at each plant. Mr. Feiler was responsible for overall planning and execution of the project, as well as data interpretation and analysis.

Mr. Feiler was a participant in the EPA supported 10 city seminar series introducing the General Pretreatment Regulations (40 CFR 403). In each city Mr. Feiler presented a three-hour training seminar on Industrial-Municipal Monitoring Systems and User Charge/Industrial Cost Recovery Systems.

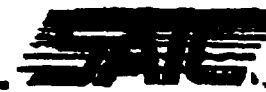
As Project Manager for the development of Revised BAT Effluent Guidelines and Pretreatment Standards for the Paint and Ink Industries, Mr. Feiler was responsible for an industry-wide sampling program, as well as the development of a national survey designed to profile the industry.

Mr. Feiler was also an author of the "Innovative Alternative Technology Assessment Manual" (EPA 430/9-78-009) and the "Federal Guidelines—State and Local Pretreatment Programs" (MCD-43). With regard to the pretreatment guidelines, Mr. Feiler acted as the Lead Engineer for the development of monitoring and inhibitory materials information. Specific information was gathered relative to the current state-of-the-art in environmental monitoring. An in-depth study

Verified for accuracy by:

Howard D. Feiler
Howard D. Feiler

Date: 3/1/95



An Employee-Owned Company

HOWARD D. FELLER

Page 3 of 4

was also conducted by Mr. Feller on the effects of toxic materials on the efficiency of municipal wastewater treatment plants. He was also an author of the EPA Industrial National Emergency Guidance Document and participated in development of an early version of EPA Simplified Solids Removal Process Design Manual. The latter document detailed municipal sludge handling technologies.

Mr. Feller was principally involved in a field investigation of the industrial waste discharge from a pharmaceutical manufacturing facility. After the investigatory phase, Mr. Feller acted as Lead Engineer for the design of wastewater treatment facilities. The wastewater treatment system was designed to bring the plant's wastewater into compliance with the local pretreatment ordinance.

As Project Manager for the design of an aerated lagoon system to pretreat wastewater generated by a brewery, Mr. Feller was involved in all aspects of the work ranging from the conceptual study to preparation of final plans. The work included laboratory analysis of the wastewater streams at the brewery, and treatability studies of the total plant effluent. These studies recommended end-of-pipe and in-plant controls.

Between 1971 and 1973 Mr. Feller served as Analytical Chemist and pilot plant operator for the evaluation of ion exchange processes for treatment of mine drainage waters at Hawk Run near Phillipsburg, Pennsylvania. In this capacity, Mr. Feller provided analysis of waters in support of various ion exchange process evaluations. Mr. Feller was also responsible for various bench scale ion exchange tests.

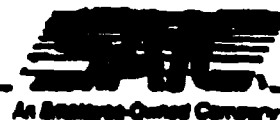
During 1970 and 1971 Mr. Feller provided laboratory and pilot plant operating services at the Bay Park Water Renovation Project, Nassau County, New York. In this project several advanced waste treatment methods were evaluated for the renovation of secondary sewage effluent to potable quality. Some of the processes evaluated included nitrification-denitrification, carbon adsorption, nutrient removal by alum and lime coagulation and break point chlorination.

As an analytical chemist between 1967 and 1970, Mr. Feller provided full analytical services for Jones Beach State Park and the Long Island State Park Commission. In this capacity he was in charge of the laboratory located in the Jones Beach Sewage Treatment Plant and maintained analytical data for this plant. In addition, Mr. Feller was responsible for sampling and analysis of pool, ocean and drinking water. He also conducted bimonthly analytical surveys of bay waters in the vicinity of the sewage plant outfall.

Verified for accuracy by:

Howard D. Feller
Howard D. Feller

Date: 3/1/95



Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal or quotation.

HOWARD D. FEILER

Page 4 of 4

PROFESSIONAL LICENSES AND MEMBERSHIPS

Registered Professional Engineer, New Jersey and Pennsylvania
Member, Water Pollution Control Federation
Member, American Chemical Society

TECHNICAL PAPERS

Darnall, D. W. and Feiler, H. D. "Recovery of Heavy Metals From Groundwaters," presented at HMCRI 12th Annual conference, "Hazardous Materials Control '91," Washington, D. C., December 3-5, 1991.

Marra, E. and Feiler, H. D. "Overview: The New Jersey Statewide Pretreatment Management Program," New Jersey Effluents, Vol. 18, No. 3, Winter 1984-85.

Langer, B. S. and Feiler, H. D. "Residuals Generation and Management in Selected Chemicals Industries," Environmental Progress, Vol. 1, No. 1, February 1982.

Feiler, H. D., Storch, P. J. and Southworth, R. M. "Organics in Municipal Sludges - Survey of Forty Cities," Presented at National Conference on Municipal and Industrial Sludge Utilization and Disposal, Alexandria, VA, May 29, 1980.

Berlow, J., Feiler, H. D. and Storch, P. J. "Paint and Ink Industry Toxic Pollutant Control," presented at 35th Annual Purdue Industrial Waste Conference, May 13-15, 1980.

Feiler, H. D., Storch, P. J. "Paint and Ink Industry Toxic Pollutant Control," presented at 35th Annual Purdue Industrial Waste Conference, May 13-15, 1980.

Feiler, H. D., Storch, P. J., and Shattuck, A. "Treatment of Priority Industrial Pollutants at POTWs." Presented at EPA Conference on Combined Municipal/Industrial Wastewater Treatment, Dallas, Texas, March 1980.

Ahmad, J., Feiler, H. D., and Liebeskind, J. "Removal and Pass-Through of Toxic Pollutants in Publicly Owned Treatment Works." Twelfth Mid-Atlantic Industrial Waste Conference, Bucknell University, Lewisburg, Pennsylvania, July 1980.

Feiler, H. D., Vernick, A. S., and Storch, P. J. "Fate of Priority Pollutants in POTWs." Presented at Eighth National Conference on Municipal Sludge Management, Miami, Florida, March 1979.

Verified for accuracy by:

Howard D. Feiler
Howard D. Feiler

Date:

3/1/95